REMARKS

Claims 1-11 are pending in the application.

Claims 2, 5 and 7-10 have been canceled without prejudice or disclaimer.

Claims 1, 3 and 11 have been amended to further clarify Applicant's claimed invention.

Acknowledgement of Priority

Applicant notes that the Examiner has not acknowledged the claim for foreign priority or receipt of the priority documents that were submitted with the application on September 26, 2003. Applicant requests that the Examiner acknowledge the claim for priority and receipt of the priority document in the next Office Action.

"Steering Range"

The Examiner requests clarification as to what is meant by the "steering range" on pages 12-13 of the Specification. Applicant has amended the specification to clarify this phrase. Applicant submits that this change does not add new matter, but rather, makes the specification consistent with figure 7. "Steering range" in the present application means the angular direction sets or sector spans in azimuth or elevation or both as shown in Fig. 7 and does not mean "depth".

Prior Art Rejections

The Examiner has cited ten different references as either anticipating or rendering obvious all of the claims. Applicant traverse these rejections because the cited references fail to disclose or suggest all of the limitations of the claims, as amended.

As amended, claim 1 requires that the switching means change electrical connections between a predetermined number of ultrasonic transducers included in plural ultrasonic transducers to a predetermined number of transmitting circuits included in plural transmitting circuits and a predetermined number of receiving circuits included in plural receiving circuits. Amended claim 11 contains similar limitations.

The currently claimed invention is clearly different than the three main prior art references cited by the Examiner - Kawagishi et al., Ossman et al. and Snyder et al. For example, Kawagishi et al. discloses an ultrasonic diagnosis apparatus which sets different transmission conditions depending on a scanning direction so that a transmission sound field in a scanning region is uniform when scanning ultrasonic beams in one frame. As described in column 12 at lines 23-32 of Kawagishi et al., elements to which a voltage is not supplied are partially set in the transmission aperture. That is, a transmission element is decimated according to a deflection angle, and the distribution density in the transmission aperture is changed. However, the switching means as recited in claim 1 is not described, and the same number of transmitting circuits and/or receiving circuits are necessary as a total number of transmission elements as shown in Fig. 16B.

On the other hand, according to the claimed invention, an electrical connection between (i) a predetermined number of ultrasonic transducers included in plural ultrasonic transducers and (ii) a predetermined number of transmitting circuits included in plural transmitting circuits and/or a predetermined number of receiving circuits included in plural receiving circuits is changed in accordance with a steering direction of the ultrasonic beam to be transmitted. As a result, a total number of transmitting circuits and/or receiving circuits can be reduced in comparison with a total number of ultrasonic transducers, while compensating a sparse pattern of the ultrasonic transducers. Further, the other ultrasonic transducers included in the plural ultrasonic transducers can be electrically connected to the other transmitting circuits and/or the other receiving circuits without the switching means. Therefore, it is possible to reduce the number of circuits or wirings in the switching means. In addition, the ultrasonic transducers are arranged in a two-dimensional array in the claimed invention, while the transmission elements are arranged in a one-dimensional array in Kawagishi et al.

The second reference, Ossmann et al., discloses variable multi-dimensional apodization control for an ultrasonic transducer. However, the switching means as recited in claim 1 is not described, rather only a variable amplifier 222 for defining characteristics of the transmit pulse applied to an ultrasonic transducer element 208 and a variable gain amplifier 242 for supplying the receive signal to a delay element 282 are described in Fig. 2.

The third reference, Snyder et al., discloses a method and an apparatus for compensating for fully or partially inoperative elements in an ultrasonic transducer array. The apparatus comprises a multiplexer 36 including switches for connecting adjacent transducer elements to each other, a flash memory 58 for storing MUX State control data for controlling the state of the multiplexer switches, and a CPU 56 for loading and retrieving MUX State control data into and from the flash memory 58 as shown in Fig. 13. When there are the same inoperative elements, the inoperative elements are compensated for by "bridging" or "shorting" them to fully operative elements. The state of the multiplexer switches is controlled by loading MUX State control data into the flash memory 58. This MUX State control data includes switch settings for connecting a defective element to an adjacent fully functional element in the transducer array. That is, the MUX State control data is not previously stored in the flash memory 58, but loaded into the flash memory 58 in accordance with presence of the inoperative elements.

On the other hand, the ultrasonic transmitting and receiving apparatus according to claim 1 comprises switching means for changing electrical connection between (i) a predetermined number of ultrasonic transducers included in plural ultrasonic transducers and (ii) a predetermined number of transmitting circuits included in plural transmitting circuits and/or a predetermined number of receiving circuits included in plural receiving circuits, and control means for controlling the switching means to partially change a sparse pattern of the ultrasonic transducers, which transmit and/or receive ultrasonic waves, in accordance with a steering direction of the ultrasonic beam to be transmitted. Further, an ultrasonic transmitting and receiving apparatus according to claim 3 comprises rewritable storing means for storing information representing plural sparse patterns of the ultrasonic transducers, which transmit and/or receive ultrasonic waves, in accordance with a steering direction of the ultrasonic beam to be transmitted.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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